

Listing of Claims:

Claims 1-24 (Cancelled)

25. (Currently amended) A method of die bonding comprising the steps of:

[[a.]] providing a structure comprising a wafer substrate separated from a carrier base ~~[[means]] by a second adhesive adhered to the carrier base means by a first adhesive~~ an adhesive layer positioned between the carrier base and the second adhesive wafer substrate;

[[b.]] laser machining through the wafer substrate~~[[,]] and the [[first]] adhesive and through the second adhesive and at most to scribe the carrier base means layer~~ to form a singulated die with an attached singulated adhesive layer, the laser machining including controlling machining parameters of a laser beam in which a first laser machining profile is used to cut through the wafer substrate and a second laser machining profile is used to cut through the adhesive layer;

[[c.]] ~~curing the structure to release the attached singulated adhesive layer~~ [[from]] to release the singulated die and the attached singulated adhesive layer from the carrier base means by curing the first adhesive and thereby enable the singulated die and the attached singulated adhesive layer to be removed from the carrier base and placed on a die pad; and

d. ~~picking and placing the die and attached singulated adhesive layer on a die pad; and~~

[[e.]] adhering the singulated die to the die pad by curing the attached singulated adhesive layer to adhere the die to the die pad.

26. (Currently Amended) [[A]] The method as claimed in claim 25, wherein the step of laser machining comprises laser machining the wafer substrate using a first laser beam with a first machining profile of selected machining parameters of the laser beam include laser pulse power, laser pulse repetition rate, laser pulse width, laser scanning speed and laser wavelength; using a second laser beam with a second such machining profile to machine the adhesive layer and using a third laser beam with a third such machining profile to machine the carrier base means, and wherein the first laser machining profile corresponds to a first set of values of the machining parameters and the second laser machining profile corresponds to a second set of values of the machining parameters, the values of the first and second sets being selected such that a speed of

machining is maximised while providing a predetermined quality of singulated dies without substantial delamination of the ~~second~~ adhesive layer and the carrier base ~~[[means]]~~ or substantial production of burrs.

27. (Cancelled)

28. (Currently Amended) ~~[[A]]~~ The method as claimed in claim 25, wherein the step of curing the ~~structure attached singulated adhesive layer~~ comprises ~~curing~~ exposing the ~~[[first]] attached singulated~~ adhesive ~~[[with]]~~ layer to ultraviolet light.

29. (Currently Amended) ~~[[A]]~~ The method as claimed in claim 25, wherein the step of ~~curing the attached singulated adhesive layer~~ adhering the singulated die to the die pad comprises heat curing the ~~second~~ attached singulated adhesive layer.

30. (Currently Amended) ~~[[A]]~~ The method as claimed in claim 25, wherein the step of laser machining through the wafer substrate comprises machining a blind via in the wafer substrate or a via through the wafer substrate and the ~~second~~ adhesive layer.

31. (Currently Amended) ~~[[A]]~~ The method as claimed in claim 25, ~~wherein the step of laser machining includes a further step, after laser machining, of~~ further comprising washing the structure after the laser machining to remove accumulated laser machining debris from the singulated die.

32. (Currently Amended) ~~[[A]]~~ The method as claimed in claim 31, wherein the step of providing a structure comprises providing a structure having a protective film to protect the structure from debris produced during the laser machining, and the step of washing the structure comprises removing the protective film and ~~accumulated laser machining~~ debris accumulated thereon.

33. (Currently Amended) ~~[[A]]~~ The method as claimed in claim 25, wherein the step of providing a structure comprises providing a structure having a wafer substrate less than 800 microns thick.

34. (Currently Amended) ~~[[A]]~~ The method as claimed in claim 25, wherein the step of laser machining comprises providing an assist gas environment for laser machining.

35. (Currently Amended) [[A]] The method as claimed in claim 34, wherein the step of providing an assist gas environment comprises providing a gas environment in which photo-dissociation produces active radicals.

36. (Currently Amended) [[A]] The method as claimed in claim 34, wherein the step of providing a gas environment reduces deposition of solid machining debris around a laser-machining site.

37. (Currently Amended) [[A]] The method as claimed in claim 25, wherein the carrier base [[means]] is one of[:]] a dicing tape, an inflexible tape suitable for thin wafer dicing or backgrinding[[:]], and a glass or other transparent solid.

38. (Currently Amended) [[A]] The method as claimed in claim 25, wherein the step of providing a structure comprises providing ~~a structure including a~~ the wafer substrate separated facedown from substantially inflexible transparent backgrinding tape [[means]] by the ~~second~~ adhesive layer, and wherein the step of laser machining is performed subsequent to backgrinding the wafer substrate.

39. (Currently Amended) [[A]] The method as claimed in claim 25, wherein ~~the step of picking and placing the~~ singulated die and the attached singulated adhesive layer ~~comprises picking and placing the singulated die and attached singulated adhesive layer~~ are removed from the carrier base and placed on another die to form a multistack die package.

40. (Currently Amended) A die bonding apparatus comprising:
a laser machining means ~~source~~ arranged to provide a laser beam for machining a structure including a wafer substrate, a carrier base, and ~~a second~~ an adhesive layer positioned between and adhered to the wafer substrate and ~~attached to the~~ carrier base ~~means by a first adhesive between the carrier base means and the second adhesive and at most scribing underlying carrier base means to form a singulated die with a singulated adhesive layer~~ first curing means arranged for curing the first adhesive to release the singulated adhesive layer from the carrier base means, the laser beam operable to machine the wafer substrate and the adhesive layer to form a singulated die with an attached singulated adhesive layer, the attached singulated adhesive layer adapted to release from the carrier base when exposed to a first curing process and adapted to adhere to a die pad when placed on the die pad and exposed to a second curing process;

a laser scanner cooperating with the laser source to impart movement of the laser beam relative to the wafer substrate;

a laser controller cooperating with the laser source and the laser scanner to control machining parameters of the laser beam; and

a memory for storing laser machining profiles used by the laser controller for controlling the laser beam to cut through the wafer substrate and the adhesive layer to thereby form the singulated die and the attached singulated adhesive layer, the laser machining profiles including a first laser machining profile used to cut through the wafer substrate and a second laser machining profile used to cut through the adhesive layer.

41. (Currently Amended) [[A]] The die bonding apparatus as claimed in claim 40, wherein the laser machining means comprises: laser source means arranged for providing a pulsed laser beam; laser beam scanning means; and control means arranged for controlling at least one of machining parameters of the laser beam include laser pulse energy power, laser wavelength, laser pulse repetition frequency rate, laser pulse width, and laser [[beam]] scanning speed and a number of scans by the pulsed laser beam, and wherein the first laser machining profile corresponds to a first set of values of the machining parameters and the second laser machining profile corresponds to a second set of values of the machining parameters, the values of the first and second sets being selected such that a speed of machining the structure is maximised while providing a predetermined quality of singulated dies without substantial delamination of the adhesive layer and the carrier base or substantial production of burrs.

42. (Currently Amended) [[A]] The die bonding apparatus as claimed in claim 41, wherein the laser machining means further comprises memory means for storing a machining profile of at least one of laser pulse energy, laser wavelength, laser repetition frequency, laser pulse width, laser beam scanning speed and the machining parameters include a number of scans by the pulsed laser beam, for use by the control means.

Claims 43-48 (Cancelled)

49. (New) The method as claimed in claim 26, wherein each of the wafer substrate and the adhesive layer is characterized by a thickness and a machinability, the first set of values for the machining parameters being selected based on the thickness and the machinability of the wafer substrate, and the second set of values for the machining

parameters being selected based on the thickness and the machinability of the adhesive layer.

50. (New) The method as claimed in claim 26, wherein the laser machining includes using a third laser machining profile to cut into a portion of the carrier base, the third laser machining profile corresponding to a third set of values for the machining parameters.

51. (New) The method as claimed in claim 50, wherein at least two of the first, second, and third laser machining profiles include the same value for at least one of the machining parameters.

52. (New) The method as claimed in claim 25, wherein the laser machining comprises:

cutting through the wafer substrate along a pattern to form multiple dice lanes; and
cutting through the adhesive layer along the multiple dice lanes after all of the multiple dice lanes are formed.